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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/039,309	11/07/2001	Eiji Sato	45672/56,682	2127

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EXAMINER	
MONDT, JOHANNES P	
ART UNIT	**PAPER NUMBER**
2826	

DATE MAILED: 09/12/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

Office Action Summary	Application No.	Applicant(s)	
	10/039,309	SATO ET AL.	
	Examiner	Art Unit	
	Johannes P. Mondt	2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 June 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,4-9,11 and 12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,4,6-9,11 and 12* is/are rejected.

7)☒ Claim(s) *5* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Amendment filed 6/21/05 forms the basis for this office action. In said Amendment Applicants added new claims 11 and 12. Comments on Remarks in said Amendment are included below under "Response to Arguments".

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. ***Claims 1, 4, 8 and 9*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyazaki et al (JP 10-333121) (IDS item BC), in view of "Liquid Crystal Device Handbook", 142nd Committee of Japan Society for the Promotion of Science, pp. 353-355, October 1990, (as submitted as IDS item CA). Miyazaki et al teach a liquid crystal display device (title) comprising:

a liquid crystal layer 12; a pair of substrates 1 and 7 provided so as to interpose the liquid crystal layer therebetween; and a plurality of pixels (pixels in areas 11) arranged in a matrix pattern (Figure B), wherein: the liquid crystal layer has a helical structure and exhibits at least two stable states including a planar state (inherently the initial state before applying any electric field is stable and exists) and a focal conic state (inherently, for sufficiently high voltage a focal conic state is reached, said focal conic state being defined as a polydomain state with a substantial random orientation of the

helical axis of the liquid crystal molecules) according to an applied voltage; and in each of the plurality of pixels, a thickness d of the liquid crystal layer has at least two values (see Figure A, and paragraphs [0015] and [0016]), and, consequently, the liquid crystal layer has at least two regions having different values of a first threshold voltage for transitioning the liquid crystal layer from the planar state to the focal conic state (this is inherent in the variable thickness because the transition is due to the existence of a local critical electric field while electric field is directly proportional to the ratio of voltage divided by distance), and wherein the thickness d of the liquid crystal layer is defined so that the first threshold voltage ("Vthmax") for transitioning from the planar state to the focal conic state in the area with the largest thickness d (said threshold voltage is called "Vth1" in Miyazaki et al; see Figure 16 and discussion of Prior Art in Miyazaki et al) is less than a second threshold voltage ("Vthmin") for transitioning from the focal conic state to the homeotropic state in a region with a smallest thickness d of the liquid crystal layer (called "Vth2" in Miyazaki et al, loc.cit.). Also please note that the threshold voltage for any transition depends linearly on the thickness of the liquid crystal layer because a transition is achieved for a critical electric field, not for a voltage per se, while inherently the voltage across the liquid crystal layer is proportional to the thickness of said liquid crystal layer. Therefore, the differences in the thickness of said crystal layer by Miyazaki et al, which are merely of the order of a percent or so (see paragraphs [0015]-[0016]), cannot possibly cause a crossover between the first threshold voltage and the second threshold voltage as the first and second threshold voltage have a ratio that is only

dependent upon the material, in this case chiral nematic crystal (see par. [0009]), and are more than a factor two apart.

Miyazaki et al do not necessarily teach the further limitation that the thickness d of the liquid crystal layer satisfies 1< d/P <15 with a helical pitch P of the helical structure. *However, it would have been obvious* to include said further limitation in view of "Liquid Crystal Device Handbook", 142nd Committee of Japan Society for the Promotion of Science, in which a liquid crystal layer with molecules of helical structure (see (1) on page 353) and three stable states (planar, focal conic and homeotropic) (hence quite analogous art) in which a ratio of d/P greater or equal to 2, and in particular 7.5, is taught (loc.cit.). It would have been obvious to include the teaching by said 142nd Committee in the invention by Miyazaki et al because (a) evidently the range is known in the art of bistable liquid chiral nematic crystal liquid displays, while Applicant is reminded that it has been held that a *prima facie* case of obviousness typically exists when the ranges of a claimed composition overlap the ranges disclosed in the prior art or when the ranges of a claimed composition do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties. See In re Peterson, 65 USPQ2d 1379 (CA FC 2003); while a liquid crystal layer that is thick in units of an elementary molecular property of the material out of which it is constituted inherently suppresses thermal fluctuations.

On claim 4: a value of the thickness d of the liquid crystal layer by Miyazaki et al increases from the center of the liquid crystal display device to each end of the liquid crystal display device (see Figures 7, 8, 9 and 11), and said increase in thickness is

effected by a succession of a plurality of substantially flat or substantially horizontal regions (said plurality of substantially flat regions is indicated by encircled numerals 1 and 2 in Figure 7, for instance) in a pixel electrode that provides a staircase pattern that rises from each of said ends to said center of the liquid crystal display device.

On claim 8: the upper surface of the lowest of the two substrates in Figure 7, hence the one closer to the liquid crystal layer than the other side of said substrate by Miyazaki et al is concave as a whole.

On claim 9: the top surface of the bottom substrate in Figures 7, 8, 9 and 11 by Miyazaki et al is concave, while the bottom surface of the top substrate in Figures 7, 8, 9 and 11 is both concave and convex according to the second definition of convex cited from Merriam-Webster (see rejection under 35 U.S.C. 112 of claim 8 given above).

3. ***Claim 7*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Miyazaki et al and the 142nd Committee as applied to claim 1 above, and further in view of Scherer et al (5,880,801). The liquid crystal display device by Miyazaki et al further comprises a pair of alignment layers 4 and 10 (see English abstract and front figure) provided respectively on the pair of substrates on one side thereof that is closer to the liquid crystal layer 12. Neither Miyazaki et al nor the 142nd Committee necessarily teach the further limitation that one alignment layer is a horizontal alignment layer and another is a vertical alignment layer. *However, it would have been obvious* to include said further limitation in view of Scherer et al, who teach top and bottom substrates 42 and 44, respectively (cf. col. 4, l. 20-60) to be aligned horizontally and vertically, respectively, so as to achieve hybrid-aligned cells by which an electro-optic response is

achieved at low voltage compared with a device with pure homogeneous alignment (cf. col. 3, l. 29-47).

Motivation to include the teaching by Scherer into the invention by Miyazaki et al and the 142nd Committee in this regard stems from the desirability to achieve response at low voltage (Scherer, loc.cit). Combination of said teaching and said invention is straightforward through the process to make HAN crystal cells as disclosed by Scherer et al (cf. col. 3, l. 7-47). Success in implementing said combination can therefore be reasonably expected.

4. ***Claim 6*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Miyazaki et al and the 142nd Committee as applied to claim 1 above, and further in view of Okada et al (JP406102485A). As detailed above, claim 1 is unpatentable over Miyazaki et al in view of the 142nd Committee. Neither necessarily teaches the further limitation as defined by claim 6. However, it would have been obvious to include said further limitation in view of Okada et al, who, teach that the value of the thickness changes continuously across the pixels (cf. Figure 8a). It would have been particularly obvious to include the teaching by Okada et al in this regard because sharp corners cause high electric field values quite unlike the electric field value desired because of the tailoring of the thickness of the liquid crystal layer, thus creating small but unwanted areas in which the threshold value of the electric field at which a transition occurs in the state of said liquid crystal.

5. ***Claim 11*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Miyazaki et al (JP 10-333121) (IDS item BC), in view of Yamamoto et al (5,696,568).

Miyazaki et al teach a liquid crystal display device (title) comprising:

a liquid crystal layer 12;

a pair of substrates 1 and 7 provided so as to interpose the liquid crystal layer therebetween; and

a plurality of pixels (pixels in areas 11) arranged in a matrix pattern (Figure B), wherein:

the liquid crystal layer has a helical structure and exhibits at least two stable states including a planar state (inherently the initial state before applying any electric field is stable and exists) and a focal conic state (inherently, for sufficiently high voltage a focal conic state is reached, said focal conic state being defined as a polydomain state with a substantial random orientation of the helical axis of the liquid crystal molecules) according to an applied voltage; and

in each of the plurality of pixels, a thickness d of the liquid crystal layer has at least two values (see Figure A, and paragraphs [0015] and [0016]), and, consequently, the liquid crystal layer has at least two regions having different values of a first threshold voltage for transitioning the liquid crystal layer from the planar state to the focal conic state (this is inherent in the variable thickness because the transition is due to the existence of a local critical electric field while electric field is directly proportional to the ratio of voltage divided by distance)

Miyazaki et al do not necessarily teach the limitation that said thickness changes continuously. However, it would have been obvious to include said limitation in view of Yamamoto et al, who, in a patent on a liquid crystal display (title), hence analogous art,

teach a continuous change of the thickness of liquid crystal layer 1 (col. 2, l. 37) through a profile characterized by a gradual ramp with taper angle preferably less than 15 degrees (col. 3, l. 10-25 and col. 6, l. 18-20 with reference to Figure 1), as opposed to the step-wise profile by Miyazaki et al, said step-wise profile being referred to as Prior Art in Yamamoto et al (col. 2, l. 45-64 and Fig. 6A) in so as to prevent unwanted discontinuity in the orientation of the liquid crystal molecules and thereby prevent the disadvantage of a residual image (col. 2, l. 46-63). *Motivation* to include the teaching by Yamamoto et al in the invention by Miyazaki et al derives at least from the prevention of residual image in any display when applied to a time sequence of images.

6. ***Claims 11 and 12*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyazaki et al (loc.cit.) in view of Ikeno et al (6,008,875).

Miyazaki et al teach a liquid crystal display device (title) comprising:

a liquid crystal layer 12;

a pair of substrates 1 and 7 provided so as to interpose the liquid crystal layer therebetween; and

a plurality of pixels (pixels in areas 11) arranged in a matrix pattern (Figure B), wherein:

the liquid crystal layer has a helical structure and exhibits at least two stable states including a planar state (inherently the initial state before applying any electric field is stable and exists) and a focal conic state (inherently, for sufficiently high voltage a focal conic state is reached, said focal conic state

being defined as a polydomain state with a substantial random orientation of the helical axis of the liquid crystal molecules) according to an applied voltage; and

in each of the plurality of pixels, a thickness d of the liquid crystal layer has at least two values (see Figure A, and paragraphs [0015] and [0016]), and, consequently, the liquid crystal layer has at least two regions having different values of a first threshold voltage for transitioning the liquid crystal layer from the planar state to the focal conic state (this is inherent in the variable thickness because the transition is due to the existence of a local critical electric field while electric field is directly proportional to the ratio of voltage divided by distance)

Miyazaki et al do not necessarily teach the limitation that said thickness changes continuously such that one of the pair of substrates has a continuous wavy shape on a liquid crystal layer side. However, it would have been obvious to include said limitation in view of Ikeno et al, who, in a patent on a liquid crystal display (with d/P >2 expressly included), hence analogous art, (N.B.: with d/P >2 expressly included, see col. 4, l. 20-22) teach the thickness of the liquid crystal display to vary continuously (thus meeting *claim 11*) in a wavy shape (thus meeting *claim 12*) (Fig. 4) so as to improve gray scale display (col. 4, l. 36-52). *Motivation* to include the teaching by Ikeno et al in the invention by Miyazaki et al thus at least derives from the improvement of the gray scale display (col. 4, l. 50-52).

Allowable Subject Matter

7. ***Claim 5*** is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base

claim and any intervening claims. The following is a statement of reasons for the indication of allowable subject matter: neither Miyazaki et al nor Yamamoto et al nor Ikeno et al teach the inequality as claimed between the thickness difference and the helical pitch, i.e., thickness difference greater than or equal half the helical pitch.

Response to Arguments

8. Applicant's arguments filed 6/21/05 have been fully considered but they are not persuasive. In particular, Miyazaki in [0016] only "incidentally" cites values for d and P: no express statement that teaches away from the range as claimed is contained in the cited portion [0016] (nor in [0017]) Miyazaki et al. Applicants' argument that the Handbook only cites a "relationship between voltage and transmissivity for a single d/P case that is greater than 2" is provided is not persuasive because the relationship is given in symbols and applies to *all* values d/P > 2. Evidently, d/P > 2 is a case important enough to be listed in the Handbook, evidently being common in the art (for an example see, e.g., Ikeno et al cited in connection with claims 11 and 12, col. 4 and Figure 4). That the Handbook is completely silent about threshold voltages for the two regions is irrelevant for the discussion of the rejection, because the examiner did not cite the Handbook in this regard (see previous office action, pages 2-4 in this regard, in which is was pointed out that the threshold voltage. That Vthmax denotes a first threshold is not a relevant claim limitation but merely a notational issue, for which the sub-sentence in which Vthmax is introduced serves as a definition. Finally, given any voltage difference between the plates the threshold voltage inherently depends on the thickness because

the electric field, which is what is felt by the helical molecules, is voltage per distance. Therefore, the rejections must regrettably be made to stand.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Bryan-Brown et al (6,549,256 B1).

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P. Mondt whose telephone number is 571-272-1919. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J. Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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JPM
August 30, 2005